Claims

What is claimed:

1. An apparatus for flexibly transmitting data from at least a first interface card to at least a second interface card, wherein the apparatus is capable of supporting multiple types of interface cards, the apparatus comprising:

a plurality of interface cards for transmitting and receiving data streams;

a cross-connect unit for receiving data streams from at least one of said plurality of interface cards, combining the received data streams so as to generate at least one cross-connected data stream, and transmitting the at least one cross-connected data stream to at least one of said plurality of interface cards;

a control unit for controlling the operation of the apparatus; and

a backplane forming parallel data buses, including a clock recovered parallel data bus, for providing connectivity between each of said plurality of interface cards, said cross-connect unit, and said control unit, wherein the data streams are transmitted between said plurality of interface cards and said cross-connect unit over the clock recovered parallel data bus without synchronization information.

2. The apparatus of claim 1, wherein the clock recovered parallel data bus has a first bus rate.

3. The apparatus of claim 1, wherein the parallel data buses support at least one bus rate.

4. The apparatus of claim 1, wherein the parallel data buses further includes a clocked parallel data bus.

SUB A17

5. The apparatus of claim 1, further comprising:

a redundant cross-connect unit; and

a redundant control unit.

6. The apparatus of claim 1, wherein each of said plurality of interface cards is capable of transmitting and receiving data streams having a plurality of different transmission protocols.

7. The apparatus of claim 1, further comprising a housing that includes a plurality of card slots to hold said plurality of interface cards, said cross-connect unit, and said control unit.

8. The apparatus of claim 1, wherein said backplane connects each of said plurality of card slots to all other of

said plurality of card slots so that a first card can communicate with a second card regardless of the location of the cards.

9. The apparatus of claim 1, wherein all of said plurality of interface cards are a first type that can receive data streams up to a first rate, and transmit data streams to said cross connect unit at the first rate.

SUB A1

10. The apparatus of claim 1, wherein:

a first set of said plurality of interface cards are a first type that can receive data streams up to a first rate and transmit data streams to said cross connect unit at the first rate, and

a second set of said plurality of interface cards are a second type that can receive data streams up to a second rate and transmit data streams to said cross connect unit at the second rate.

11. The apparatus of claim 2, wherein the first bus rate is approximately 311 MHz.

12. The apparatus of claim 1, wherein the clock recovered parallel data bus is a 32-bit clock recovered parallel data bus.

13. The apparatus of claim 9, wherein said first type of interface cards are high-speed interface cards and the first rate is an STS-192 rate.

14. The apparatus of claim 13, wherein STS-192 data streams are transmitted over four 8-bit clock recovered data buses in parallel to each other, forming a 32-bit clock recovered parallel data bus.

SUBA1

15. The apparatus of claim 10, wherein said first type of interface cards are high speed interface cards, the first rate is an STS-192 rate, said second type of interface cards are low speed interface cards, and the second rate is an STS-48 rate.

16. The apparatus of claim 15, wherein STS-192 data streams are transmitted over four 8-bit clock recovered data buses in parallel to each other, forming a 32-bit clock recovered parallel data bus, and STS-48 data streams are transmitted over a single clock recovered 8-bit data bus.

17. The apparatus of claim 1, wherein a first set of said plurality of interface cards support a first set of interface subsystems and a second set of said plurality of interface cards support a second set of interface subsystems.

18. The apparatus of claim 17, wherein the first set of interface subsystems forms a telecommunications plane and the second set of interface subsystems forms a data plane.

19. The apparatus of claim 1, wherein each of said plurality of interface cards format the received data streams, which may have a plurality of different transmission protocols, into payloads having a single format.

SUB A1

20. The apparatus of claim 1, wherein said interface cards include an oscillator that is phase locked to one of the data streams from the cross-connect unit, said oscillator used for clock recovery.

21. The apparatus of claim 20, wherein said oscillator is an approximately 155 MHz oscillator.

22. The apparatus of claim 1, wherein said control unit includes a reference clock.

23. The apparatus of claim 22, wherein said cross-connect unit includes an oscillator that is phase locked to said reference clock, said oscillator used for clock recovery.

24. The apparatus of claim 23, wherein said oscillator is an approximately 155 MHz oscillator and said reference clock is an approximately 19 MHz reference clock.

25. The apparatus of claim 4, further comprising additional interface cards, wherein additional data streams are transmitted between said additional interface cards and said cross-connect unit over the clocked parallel data bus, the additional data streams including data and synchronization information.

SUB A7

26. The apparatus of claim 25, wherein the clocked parallel data bus has a second bus rate.

27. The apparatus of claim 25, wherein all of said additional interface cards are a third type that can receive data streams up to a third rate, and transmit data streams to said cross connect unit at the third rate.

28. The apparatus of claim 25, wherein:

a first set of said additional interface cards are a third type that can receive data streams up to a third rate and transmit data streams to said cross connect unit at the third rate, and

a second set of said additional interface cards are a fourth type that can receive data streams up to a fourth rate and

transmit data streams to said cross connect unit at the fourth rate.

29. The apparatus of claim 26, wherein the second bus rate is approximately 155 MHz.

30. The apparatus of claim 25, wherein the clocked parallel data bus is a 16-bit clocked parallel data bus.

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31. The apparatus of claim 27, wherein said third type of interface cards are high-speed interface cards and the third rate is an STS-48 rate.

32. The apparatus of claim 31, wherein STS-48 data streams are transmitted over four 4-bit clocked data buses in parallel to each other and forming a 16-bit clocked parallel data bus.

33. The apparatus of claim 28, wherein said third type of interface cards are high speed interface cards, the third rate is an STS-48 rate, said fourth type of interface cards are low speed interface cards, and the fourth rate is an STS-12 rate.

34. The apparatus of claim 33, wherein STS-48 data streams are transmitted over four 4-bit clocked data buses in parallel to

each other and forming a 16-bit clocked parallel bus, and STS-12 data streams are transmitted over a single 4-bit clocked data bus.

35. An apparatus for routing data from at least a first interface card to at least a second interface card, wherein the apparatus is capable of supporting multiple types of interface cards, the apparatus comprising:

a plurality of interface cards including

a plurality of clock recoverable interface cards for transmitting and receiving data streams having no synchronization information, and

a plurality of clocked interface cards for transmitting and receiving data streams including data and synchronization information;

a cross-connect unit for receiving data streams from at least one of said plurality of interface cards, combining the received data streams so as to generate at least one cross-connected data stream, and transmitting the at least one cross-connected data stream to at least one of said plurality of interface cards;

a control unit for controlling the operation of the apparatus; and

a backplane forming parallel data buses including clock recovered parallel data buses and clocked parallel buses, said

parallel data buses providing connectivity between each of said plurality of interface cards, said cross-connect unit, and said control unit.

36. The apparatus of claim 35, wherein data streams to and from said plurality of clocked interface cards is transmitted over the clocked parallel data buses, and data streams to and from said plurality of clock recoverable interface cards is transmitted over the clock recovered parallel data buses.

SUB A7

37. A method for flexibly transmitting telecommunications signals from at least a first interface card to at least a second interface card using a cross-connect apparatus, the method comprising:

receiving at least a first telecommunications signal at a first interface card;

transmitting a first payload, which includes the at least a first telecommunications signal, from the first interface card to a cross-connect unit;

receiving the first payload at the cross-connect unit;

removing the first telecommunications signal from the first payload and inserting the first telecommunications signal in a second payload; and

transmitting the second payload, which includes at least the first telecommunications signal, from the cross-connect unit to a

second interface card, wherein the first payload and the second payload do not include synchronization information and are transmitted over a clock recovered parallel data bus formed in a backplane of the cross-connect apparatus.

38. The method of claim 37, wherein the at least a first telecommunications signal received by the first interface card includes a plurality of signals having different transmission protocols.

39. The method of claim 38, wherein the first interface card transmits the plurality of signals having different transmission protocols to the cross-connect unit at a standard transmission protocol.

40. The method of claim 37, further comprising pre-aligning the at least a first telecommunications signal at the first interface card prior to said transmitting a first payload.

41. The method described in claim 40, wherein said pre-aligning is accomplished by adjusting a programmable offset.

42. The method of claim 37, further comprising:

aggregating the telecommunications signals received from a data plane to form an aggregated telecommunication signal, the

data plane being formed by connecting several interface cards together; and

transmitting a third payload, including the aggregated telecommunication signal, to the cross-connect unit.

43. The method of claim 42, further comprising removing the aggregated telecommunication signal from the third payload and inserting the aggregated telecommunications signal in a fourth payload.

44. The apparatus of claim 37, further comprising:

receiving at least a second telecommunications signal at a third interface card;

transmitting a third payload, which includes the at least a second telecommunications signal, from the third interface card to the cross-connect unit;

receiving the third payload at the cross-connect unit;

removing the second telecommunications signal from the third payload and inserting the second telecommunications signal in a fourth payload; and

transmitting the fourth payload from the cross-connect unit to a fourth interface card, wherein the third payload and the fourth payload include data and synchronization information and are transmitted over a parallel clocked data bus formed in the backplane.